Rijksinstituut
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en Milieu

LETTER REPORT

COMPARISON OF METHYL BROMIDE CONCENTRATIONS RESULTING FROM VARIOUS METHODS OF SEALING FUMIGATION TENTS FOR STACKED PALLETS OF COCOA BEANS

On behalf of Mr W. Veldman, VROM Inspectorate *regio Zuid-West*

CC

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1. INTRODUCTION

Fumigation with methyl bromide is used to prevent insect infestations. During the fumigation, the objects to be fumigated are subjected to a prescribed methyl bromide concentration that differs according to the product group. After this, de-gassing takes place, with or without forced ventilation.

Fumigation of cocoa beans is a common practice. Stacked pallets with bales of cocoa beans are covered in an airtight fashion in plastic film, after which methyl bromide gas is injected into these plastic "tents". Sometimes the plastic film is sealed with tape to the floor of the warehouse, in other cases water-filled tubes are used. These water-filled tubes make an airtight seal by pressing the plastic film against the floor.

Previous measurements conducted by the RIVM-IEM, on behalf of the *Inspectie Milieuhygiëne* (Environmental Inspectorate) have shown that with this method of sealing (water-filled plastic tubes), high concentrations of methyl bromide are still measurable in the warehouse. The question is to what extent the use of tape can actually provide an airtight seal of the plastic fumigation tents. The *Inspectie Milieuhygiëne* therefore commissioned the RIVM-IEM to conduct methyl bromide measurements during a fumigation procedure in which tape was used to seal the plastic tents to the floor. The present report contains the results of these measurements on 7 and 8 October 2000; it also makes a comparison of these results with measurements taken in a warehouse during the fumigation of stacked pallets of cocoa beans in plastic tents sealed with water-filled tubes (measurement on 10 and 11 June 2000, RIVM-IEM report 434/00 IEM/tk).

2. AIM

To compare the concentrations of methyl bromide measured during the fumigation of stacked pallets of cocoa beans covered in plastic film "tents", when using various methods of sealing the plastic film.

3. IMPLEMENTATION

3.1 FUMIGATION

On 7 October 2000, stacked pallets of cocoa beans were fumigated in a warehouse in Amsterdam. To this end, the stacked pallets were covered with a "tent" of plastic film, which reached to the floor with some overlap. The film was sealed to the floor in an airtight fashion using tape. These stacked pallets of goods covered with an airtight "tent" are called *klampen* in Dutch. These tents were then fumigated by making a hole in the film through which a hose was inserted; the opening around the hose was sealed and then methyl bromide gas was injected into the tent using a vaporizer.

3.2 MEASUREMENT

Instrument: Photovac 10SPlus portable gas chromatograph, equipped with a CPSil5 column, temperature 40°C, flow 12 ml/min

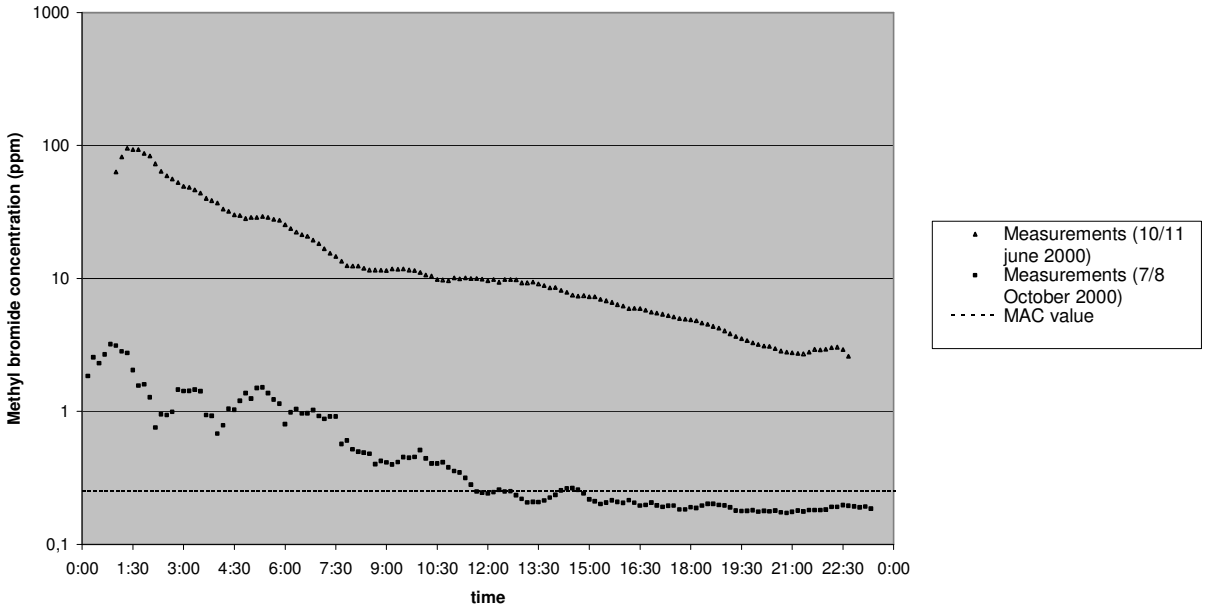
The Photovac 10SPlus portable gas chromatograph was placed on the floor of the warehouse containing the stacked pallets of cocoa beans to be fumigated; the intake opening was located at approximately 0.5 m from the floor. During the fumigation, this instrument took an air sample

every 10 minutes that was analyzed for methyl bromide by means of gas chromatography. The analysis results are shown in Appendix 1. Measurements with the Photovac were conducted only in the warehouse.

4. RESULTS

Appendix 1 lists the methyl bromide concentrations measured on 7 and 8 October 2000 with the Photovac 10SPlus during the fumigation of the stacked pallets of cocoa beans covered in plastic tents that were sealed with tape. In Figure 1, the results from the Photovac 10SPlus are shown on a graph, converted to progressive hourly average values during the fumigation phase. The graph also includes the values measured on 10 and 11 June 2000 during the fumigation of film-covered stacks of baled cocoa beans that were sealed with water-filled tubes.

Figure 1: The concentrations of methyl bromide (ppm) measured in a warehouse during the fumigation of film-covered stacked pallets of cocoa beans on 10/11 June 2000 (sealed with a water-filled tube) and on 7/8 October 2000 (sealed with tape)



5. DISCUSSION

The results of the measurements with the Photovac 10SPlus on 7 and 8 October 2000 showed that the fumigation tents that were sealed with plastic tape were not airtight: immediately after injecting the methyl bromide, the methyl bromide concentration in the warehouse increased to a maximum of 5 ppm, with an average concentration of 2 ppm during the first two hours. After this, the concentration fell to approximately 0.2 ppm during the period that the plastic tents were filled with gas (24 hours).This decline led us to suspect that the concentration inside the fumigation tents also continued to decline; as a result it is uncertain that the prescribed methyl bromide concentration inside the tents could be maintained during the fumigation period.

The MAC value for methyl bromide is 0.25 ppm. It is striking that before the start of the fumigation on 7 October 2000, concentrations of methyl bromide were measured that significantly exceeded the MAC value. An explanation for the high measured values could

possibly be found in the release of methyl bromide residues from previous fumigations when rolling out the hoses that are used to inject the gas into the fumigation tents.

Compared with the measurements on 10 and 11 June 2000 (with plastic-filled tubes for sealing the fumigation tents), the concentrations of methyl bromide measured on 7 and 8 October 2000 were much lower.

6. CONCLUSIONS

Neither of the methods – water-filled tubes or tape – that are used for sealing fumigation tents covering stacked pallets of cocoa beans are airtight.

However, sealing with tape turned out to be more effective than sealing with water-filled tubes: during the 24-hour fumigation period, the concentration of methyl bromide in the warehouse with tape-sealed fumigation tents fell to around the MAC value (0.25 ppm of methyl bromide). With water-filled tubes, after 24 hours the MAC value in the warehouse was still being exceeded by a large margin.

7. RECOMMENDATIONS

It is advisable to determine whether the plastic film used for the fumigation tents is actually impermeable to methyl bromide gas, as is prescribed for methyl bromide fumigation. If methyl bromide gas penetrates the film, a good seal around the edges would certainly not prevent the methyl bromide concentration outside the tents from increasing. For that matter, there are no prescribed methods for determining the permeability of the plastic film used.

During the preparations for the fumigation on 7 October 2000, methyl bromide concentrations were measured that exceeded the MAC value, even though the employees were working without respiratory protection. An explanation for these high levels could be the release of methyl bromide residues from previously used hoses. It is advisable to conduct additional research into this aspect so it becomes clear whether or not safety measures should be taken during the preparatory phase.

APPENDIX 1 RESULTS OF METHYL BROMIDE MEASUREMENTS ON 7 AND 8 OCTOBER 2000

time	MeBr conc. (ppb)
7 October 2000	
9:13:00	195
9:23:00	145
9:33:00	4932
9:43:00	2418
9:53:00	663
10:03:00	1063
10:13:00	3672
10:23:00	3688
10:33:00	4329
10:43:00	3249
10:53:00	642
11:03:00	2217
11:13:00	3287
11:23:00	820
11:33:00	843
11:43:00	829
11:53:00	594
12:03:00	702
12:13:00	1787
12:23:00	770
12:33:00	1105
12:43:00	2923
12:53:00	528
13:03:00	1809
13:13:00	908
13:23:00	915
13:33:00	525
13:43:00	458
13:53:00	590
14:03:00	1441
14:13:00	2210
14:23:00	447
14:33:00	1308
14:43:00	1446
14:53:00	836
15:03:00	3464
15:13:00	529
15:23:00	580
15:33:00	721
15:43:00	419
15:53:00	1757
16:03:00	1429
16:13:00	892
16:23:00	334
16:33:00	424
16:43:00	2030
16:53:00	
17:03:00	726
17:13:00	481
17:23:00	423
17:33:00	647
17:43:00	736
17:53:00	306
18:03:00	377
18:13:00	380
18:23:00	602
18:33:00	340
18:43:00	418
18:53:00	320
19:03:00	308
19:13:00	694
19:23:00	523
19:33:00	390
19:43:00	355
19:53:00	598
20:03:00	348
20:13:00	336
20:23:00	391
20:33:00	393
20:43:00	426
20:53:00	230
21:03:00	294
21:13:00	233
21:23:00	220
21:33:00	268
21:43:00	208
21:53:00	278
22:03:00	260
22:13:00	274
22:23:00	227
22:33:00	217
22:43:00	190
22:53:00	188
23:03:00	210
23:13:00	236
23:23:00	212
23:33:00	220
23:43:00	243
23:53:00	268

Time	MeBr conc. (ppb)
8 October 2000	
0:03:00	329
0:13:00	257
0:23:00	227
0:33:00	205
0:43:00	191
0:53:00	210
1:03:00	218
1:13:00	180
1:23:00	230
1:33:00	234
1:43:00	177
1:53:00	202
2:03:00	231
2:13:00	182
2:23:00	184
2:33:00	189
2:43:00	245
2:53:00	179
3:03:00	158
3:13:00	202
3:23:00	193
3:33:00	181
3:43:00	179
3:53:00	195
4:03:00	189
4:13:00	234
4:23:00	212
4:33:00	178
4:43:00	175
4:53:00	183
5:03:00	198
5:13:00	164
5:23:00	168
5:33:00	
5:43:00	191
5:53:00	181
6:03:00	172
6:13:00	165
6:23:00	188
6:33:00	164
6:43:00	
6:53:00	183
7:03:00	182
7:13:00	176

Time	MeBr conc. (ppb)
7:23:00	182
7:33:00	181
7:43:00	183
7:53:00	189
8:03:00	221

Time	MeBr conc. (ppb)
8:13:00	182
8:23:00	208
8:33:00	174
8:43:00	177

Time	MeBr conc. (ppb)
8:53:00	207
9:03:00	195
9:13:00	172
9:23:00	165